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ABSTRACT

A computer-based system was developed for physically handicapped students using a learning laboratory to develop prerequisite skills for regular vocational or technical courses. Among criteria developed for the system were that it should not require manual dexterity, should use commercially available and reasonably priced hardware and software, and should provide means for communication. Three applications packages were installed after months of experimentation and development. Evaluation of the results revealed improvements in student achievement and significant increases in time on task. It is concluded that field development of computer-based systems which serve a particular group of needs is both possible and practical. (CL)

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DEVELOPING A COMPUTER-BASED LEARNING TOOL FOR HANDICAPPED STUDENTS

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ABSTRACT

Innovative uses of computer technology can provide expanded learning opportunities for handicapped persons. Educators can take advantage of computer technologies without immersing themselves in it. This paper describes the development of one computer-based system which solved many classroom needs for both teachers and their handicapped students.

The promise of computer-based technology is often empty for handicapped persons. The very population that ought to benefit the most from new technologies is often bypassed. Economics of scale, high-priced "custom-built" devices, lack of in-depth understanding on the part of therapists, aides and instructors: these and other reasons stand in the way of handicapped computer users realizing the "high tech promise."

Historically, educators have been creative innovators. Desktop computers are becoming commonplace in classrooms across the United States. These computers do not come complete with solutions to all classroom problems. They do come with a potential for supporting the efforts of creative, innovative educators. Teachers must remember that they are the masters of their craft, teaching, and that these new machines are simply additional tools to serve in practicing that craft. Like any tool, they are most effective in the hands of practiced, expert craftspeople.

A Practical Problem

A learning laboratory at Fox Valley Technical Institute's Oshkosh, Wisconsin campus (FVTI-Oshkosh) is a focal point for building fundamental academic skills. Students use the lab to develop prerequisite skills for regular vocational or technical courses. These students are high school dropouts, adults returning to the classroom after extended absences, and handicapped students. All students follow a fairly structured schedule and, at any point in time, there may be from 2 to 20 of them in the lab. Goals are established for each student and appropriate materials

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are supplied for the students to master their objectives.

The lab instructor must cover a broad range of subjects within a broad range of comprehension levels. While the lab concept is based on individualized learning, there are many demands for teacher attention. Instructors coach students, maintain individual progress records, administer evaluations and supply materials for study and review.

When physically handicapped students are introduced to the learning lab, two distinct problems may arise: (1) if the student is severely handicapped, communication between instructor and student may be difficult and constrained. (2) Students may not be able to use normal methods to complete practice exercises and assignments. For example, for a student unable to use paper and pencil, it is difficult to demonstrate mastery of math concepts. The problem is exacerbated if the student is also unable to communicate verbally.

Teaching severely handicapped students requires constant, direct teacher-student interaction. Where student teacher ratios are 10:1 or lower, the required individual attention is available. In the learning lab described here, individual time is not available. If the teacher concentrates on communicating with the handicapped student, the remainder of the class may be ignored; handicapped learners may be unable to progress when the teacher is attending the rest of the class.

Developing a Model

During the 1983-84 school year, FVTI-Oshkosh staff began investigating the use of computers as aids for learning lab teachers. Initial discussions isolated handicapped students as the first priority for computer use.

Defining requirements was the first order of business. Three prime requirements surfaced immediately:

1. The system must not require delicate manual dexterity. (Student users should not have to to use a computer keyboard for input.)
2. The system should provide means for communication. (Student users should be able to participate in "conversation." They should have the ability to record messages for later use and review by printing output to demonstrate task mastery.)
3. The computer should assist handicapped students in completing assignments. (Mathematical capability is necessary for those students who cannot use pencil and paper.)

These early requirements were shaped in part by needs of existing handicapped students. The system which evolved was not intended to solve all learning/communication problems for all handicapped persons. At the time of early planning and goal setting, two handicapped students were using the learning lab. They were similar in several respects: both were male, in their early twenties, afflicted with cerebral palsy, confined to wheelchairs, and unable to speak. One student had earned a high school diploma, the other was working toward that degree. Although both students had fine motor control disabilities, one was more severely afflicted.

Differences in students' abilities to use their hands pointed up the need for a fourth criterion:

4. One system will not serve the needs of all users, even within the confines of a very small universe of users. (The computer system or systems must be flexible; it must be adaptable to a variety of skills and needs.)

Two additional criteria were added, related to the tools employed by any system to be implemented:

5. All hardware is commercially available at reasonable market prices (no premiums

for "handicapped" designations).

6. Required software to integrate the hardware functions is also commercially available at reasonable market prices or can be developed with minimal difficulty.

The six-criteria model that represented FVTI-Oshkosh requirements describes the attributes of a computer-based system for use in an educational setting. It was not intended to define a complete system for use by all handicapped persons with communicative disorders. Limitations built into the model were recognized and accepted.

Developing the Application System

Once the needs were defined, attention turned to development of the required computer system. Although similar systems did exist, there were none that met all the defined needs. No single piece of hardware was available that satisfied all the defined needs. The hardware finally assembled consisted of an Apple IIe computer, an Epson printer, a Power Pad (touch sensitive tablet), and Echo II (a speech synthesizer).

The integrating software programs were not available. Learning lab staff decided that custom programs should be developed--if development could be completed by outside programmers. A local software developer agreed to participate in the project, writing the software in return for design and testing assistance. Ownership of the resulting software is vested in the software development company.

Months of experimentation and development followed, during which the staff explored different layouts for the touch sensitive tablet and different functions for the user. Three application packages were finally installed. Two performed all functions outlined in the requirements. One served a single function. The basic difference between the applications was the size of the "keys" defined on the touch sensitive tablet. The three programs are:

1. The Speaker II Keys are 1 by 1 inch squares, with numeric, alphabetic, and special characters. All functions are accommodated. The operative portion of the touch sensitive pad is 12 to 9 inches.
2. The Speaker II Keys are 1-1/2 by 1-1/2 inches. Numbers, letters, and special characters are present. All functions are available. The entire pad is used.
3. Two-By-Two Keys are 2 by 2 inches. Only alphabetic characters are present. Only the speech synthesis function is available. The entire pad is used.

Implementing the Software

During the development phase, test versions of the programs were installed in the learning lab. The handicapped students tested the systems and suggested modifications. Student interest in the packages was high, but there was a danger that this was due to the novelty factor or the fact that they were receiving additional attention.

When testing was completed, user documentation was prepared and the final touch tablet templates prepared. The User Manual addresses two audiences: The system user and an assisting aide. Material addressed directly to the user defines the functions of the system and how to use them. Material directed to the aide describes necessary functions that the user may not be able to perform (setting up the system and using the computer keyboard, for example).

Evaluating Results

When the completed programs were installed in the learning lab, teachers carefully monitored the results. The first three model criteria

were satisfied: student users could generate verbal and printed communication and complete math problems.

The hardware installed was, indeed, commercially available. The Apple IIe computer and the Epson Printer were the most expensive of the hardware items purchased. These components are usable in several other situations within the school, so the capital risk of installing the total system was minimized. (The touch sensitive tablet and speech synthesizer can also be used in other settings, but educational software for them is limited.)

Software programs were not available at the onset of the project; they were developed as part of the project. While FVTI-Oshkosh spent staff time, defining and testing the systems, they did not have to invest time and money required for program development. (The staff is also free of the ongoing maintenance tasks involved with computer software packages.)

Student achievement improved. The math portion of the programs allowed instructor verifiable calculation of problems. The printing capability accommodated preparation of student answers for instructor review. The speech synthesis function did, in fact, allow the nonverbal students to participate in conversation.

Most important, time on task increased significantly. The observations were subjective, but instructors concluded that improved performance was due to higher student motivation and increased time spent on learning tasks. An example may best illustrate this point. One of the students had developed a habit of taking a nap during the fifteen minute afternoon break. After he began working with The Speaker III, he stopped napping and continued work on his assignments during the break.

Conclusions

As a result of their experience with this software development, the FVTI-Oshkosh staff arrived at three significant conclusions.

First, computers can be effective tools for educators. Teachers must be willing to take charge of the computers in their classrooms, just as they control any of the other tools of their trade. Second, handicapped persons can adapt to and benefit from computer-based systems when the systems are designed appropriately to meet their needs.

Computer software programs do not exist to solve every conceivable need. Field developed programs are commonly believed to be the province of computer scientists and professional programmers. That is a myth. The final conclusion was that field development of computer-based systems which serve a particular group of needs is both possible and practical.

Computer based systems can have a positive impact on handicapped learners and expand the effectiveness of their instructors. The promise of computer technology is a step closer for handicapped persons.

The project described in this paper is successful because of the vision and persistence of two FVTI--Oshkosh staff members: Sylvia Gasser, a Learning Lab instructor, and Marty Bruflat, Special Education Coordinator. They knew what they wanted. Because they were willing to walk uncharted trails, they got it.

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